"AN ELECTRIC CHRISTMAS TREE" IN THIS NUMBER

THE ELECTRICAL EXPERIMENTER

JAN. 1915

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THE EXPERIMENTER'S MAGAZINE

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THE ELECTRICAL EXPERIMENTER

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The Société Radio-Electrique System

By Frank C. Perkins

THE accompanying illustration, Fig. 1, shows the unique wireless receiving equipment developed at Paris and consists of a universal resonator, with electrolytic detectors and also another type of detector of the Societe Francaise Radio Electric type. A storage battery is used of 4 volts potential and capacity of 20 ampere hours. At the Eiffel tower wireless station, an equipment of 10 kilowatts capacity, has communicated with the Russique Dakar station at a distance of 4,000 kilometers.

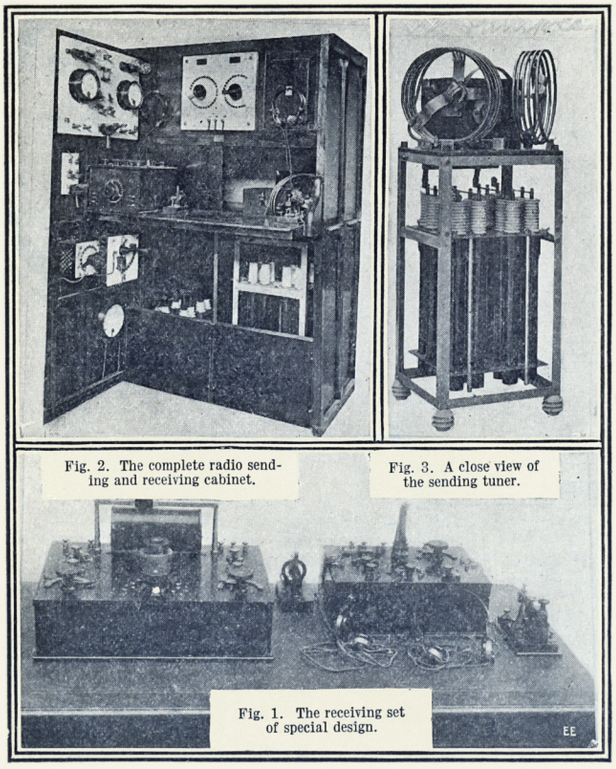


Fig. 2. The complete radio sending and receiving cabinet.

Fig. 3. A close view of the sending tuner.

Fig. 1. The receiving set of special design.

In Africa there is a wireless installation of the Société Francaise Radio Electrique at Braxxaville, capitol of Congo Francaise, which is capable of communicating with Stanleyville, a distance of 1,600 kilometers.

In the accompanying illustration, Fig. 2, may be seen a complete wireless sending and receiving station of the Société Francaise Radio Electrique including the switchboard, transformer, detectors and manipulating apparatus as well as the equipment for the instantaneous variation of the wave length. The transmission equipment also noted in this photograph is shown in Fig. 3, where this apparatus may be seen in greater detail, and particularly the high voltage tubular condensers, with the tuning inductances.

WIRELESS TELEGRAPHY FROM AEROPLANES.

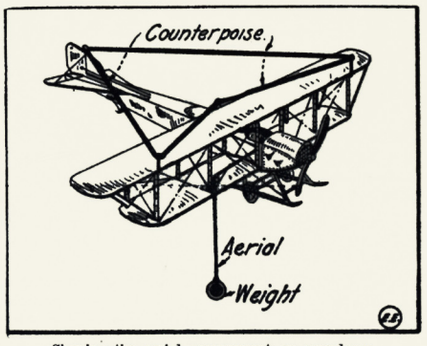
It is almost impossible in practice to send a wireless message to a man in an airship. Not that the wireless waves fail to reach him, but that the noise of the engine is so terrific that it makes the faint signals in the telephone receivers inaudible. Thus there exists a good opportunity for radio designers and experimenters to perfect a visible receptor, which will indicate the radio signals by short flashes in a lamp or bulls-eye.

It is, however, comparatively easy for an aviator to send wireless messages to the earth, says Marcus D. Manton, in Aircraft.

The apparatus required to make this wireless transmission possible, comprises an alternator and transformer, the alternator being driven by the engine used for propelling the machine, or by means of an auxiliary engine or motor of some description, or in place of this alternator and transformer an induction coil may be used, the electric current being supplied to it from a battery of accumulators.

A key is also necessary to enable the operator to make and break the electric circuit at will, in order to produce dots and dashes for transmitting a message in the Morse or other pre-arranged code.

To surmount the difficulty of having no direct ground connection, a device called a counterpoise, is used as our illustration shows. The antennae system consists of two distinct aerials, apart from one another and each highly insulated. The aerials on airships usually consist of a single copper cable about 60 to 100 yards long, one end of which is connected to the instruments; to the free end a weight is attached and then lowered over the side of the machine so that it hangs vertically below the machine when in flight. A winch is provided so that the aerial may be quickly wound up or down.



Showing the aerial arrangement on aeroplanes.

In the event of the machine having to make a forced landing and giving no time to wind up the aerial, the wire cable is severed by means of an aerial cutter which is fitted to the side of the winch, and the wire falls clear of the machine so that the aeroplane lands in the ordinary way without any danger of the aerial catching in trees or being tangled up by the propeller.

The counterpoise used in place of the ground connection consists of a system of wires running from the planes to the tail of an aeroplane or from end to end of the nacelle of a dirigible. The figure shows how a counterpoise and aerial are fitted to an aeroplane. Such machines take two men, pilot and operator.

WIRELESS RATES TO GERMANY.

It was announced recently by Acting Secretary of State, Robert Lansing, that when the Goldschmidt wireless station at Tuckerton, N. J., is reopened shortly, that the rate per word to Germany via the Tuckerton system will be 50 cents per word.

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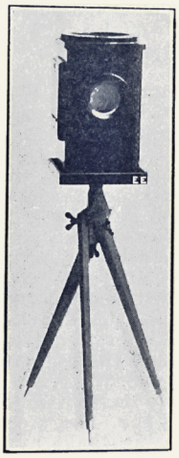
A SWISS AUTOMATIC ELECTRIC WATER FINDER.

By Frank C. Perkins.

A unique automatic water finder has been developed in London, England. It is said to be based upon physical principles, scientifically and technically investigated and proved in practice in different countries, to be capable of discovering subterranean water courses or as they are usually called "springs." It is superior to a divining rod or similar contrivances as it works automatically, enabling any unskilled person following the directions for working to readily ascertain whether subterranean flowing water exists at an accessible depth, also the course and extent of same, before going to the expense of costly boring operations.



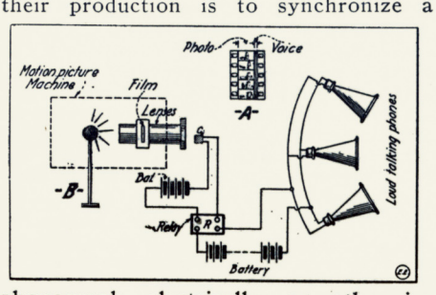
The apparatus works on the principle of indicating the strength of the natural electric terrestrial currents existing in the upper layers of the earth, there being in connection with these currents an interchange of electricity between the atmosphere and the ground.

It has been found that the vertical earth-air currents which naturally seek the path of greatest conductivity undergo important variations increasing remarkably in strength in the vicinity of subterranean water courses, the flowing waters of which are charged with electricity to a certain degree. These changes bring about the peculiar oscillations of the magnetic needle of the apparatus which usually swings to and fro symmetrically to its position of rest attaining over powerful springs an amplitude of 50 degrees or more.

The apparatus only indicated water courses flowing underground in a natural state and not artificial water conduits or sources that have sprung up to daylight. It is held that observations should be taken only in clear, calm weather and over dry surface of the ground, between nine and twelve o'clock in the morning and three to six o'clock in the afternoon, these being the hours of greatest activity of the vertical-earth-air currents.

SELENIUM AND TALKING PICTURES.

We all have heard at some time or other of the wonders of talking moving pictures. Some of us have seen them, and one of the usual arrangements for their production is to synchronize a



phonograph electrically or otherwise with a motion picture machine. Another method, now strongly in vogue with inventors is to, in some way impress the speech on the moving film itself, and then to reproduce the speech from the film. Of course, the easiest and most practical manner of doing this is to photograph the *"Talk"* right on one edge of the film as seen in the sketch A. This is accomplished by a manometric capsule or by other means. Then, when the light shines thru the lenses (see B in sketch) the strength of same is caused to vary by the differing shades of the voice film record, and these light variations in turn are thrown on to a selenium cell C. This cell changes its electrical resistance with a change in the strength of the light thrown on it; and hence the cell by its small current variation thru a relay R, controls the heavier current thru a series of loud talking 'phones, as shown. These are placed around the theatre auditorium. The idea here is excellent, but several obstacles are to be overcome before commercial application is a perfected reality instead of a dream; such as the cell inertia, or sluggishness of action; small current carrying capacity of the cell; or else perfecting a telephonic relay having an intensifying power much above anything now available, including the audion amplifier. So there is a large field open here for the experimenter and the simplest solution of the problem will undoubtedly bring a fortune to the successful genius perfecting it.

A SHORT WAVE RECEIVING JIGGER OR LOOSE COUPLER.

I have long been of the opinion that if the best results are to be obtained, it is necessary to fit the jigger to the wave length, i. e., for short waves to use a small jigger, and for long waves to use a large one, or to add external inductance both to the primary and secondary as required.

To test these theories, I have just completed a jigger capable of tuning to 600 metre waves, but no more, says V. W. Delves-Broughton in the Model Engineer, London.

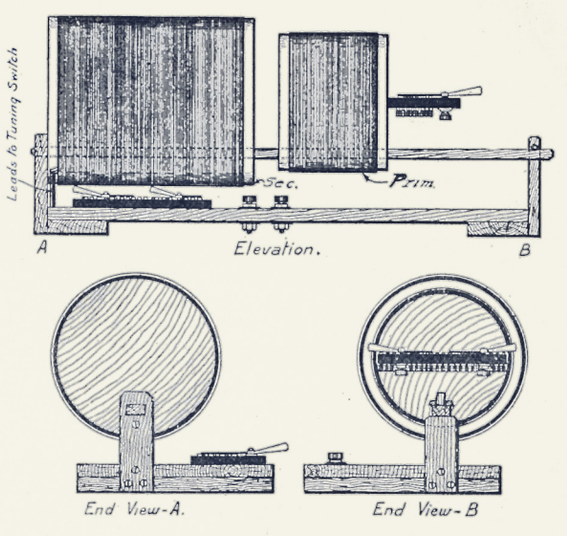
Both primary and secondary are wound on cardboard cylinders, thoroughly soaked in Sterling varnish and baked for about eight hours, the construction of which is described in detail below.

The primary is wound with enameled wire consisting of seven strands of No. 33 B. & S. wire laid up into a single cable (No. 32 near enough). Between each turn a strand of string is wound in such a manner that each strand of wire was separated from its neighbor by rather over ½ millimetre. This coil is tapped off at one end to every second turn by a five-stud switch, and the remaining thirty turns tapped off in the three equal sections of ten turns, thus enabling any number of turns to be taken from two to forty in steps of two turns. The diameter is nine centimetres and the length occupied by the winding is six centimetres.

The secondary is wound with 125 turns of No. 31 B. & S. To further increase the distance between the turns of wire, a strand of thick machine thread was wound between each turn of wire. One end of this coil is tapped off to a five stud switch to every five turns, and the remainder to a four-stud switch to every twenty-five turns, thus enabling any number of turns from five to 125 turns to be selected in steps of five turns. The diameter and length of this coil is twelve centimetres. The primary is, contrary to the usual practice, made to slide inside the secondary, and great attention has been paid to insulation thruout.

The insulation between adjacent sections I tested with 100 volts and a very sensitive galvanometer, which will show a deflection of three degrees with the heat of the hand applied to a small thermo junction and the greatest deflection obtained was less than ½ degree. The stud switches are on ebonite (hard rubber) bases, and the connections run in with hard wax, so that dirt cannot form a short. I did, at first, think of using ebonite tubes to wind the inductances upon, but I found that cardboard, treated as already explained, formed nearly as good an insulator without the disadvantage of a high co-efficient of capacity; and also because I found that it would not stand the high temperature at which it is necessary to bake Sterling varnish, with which I had already determined to treat the windings.

The method of making the cylinders I believe to be original. I first obtained two bottles the correct diameter for the inside of the tubes, and a sheet of strawboard about 1/16 inch thick. The strawboard was cut into strips a little wider than the length of the finished cylinders, and planed off with a sharp iron plane to feather edges at the ends. The strips were then slightly damped and put away for the night, and in the morning were glued round the bottles till a sufficient thickness was attained, and then tied up tightly and put on the rack over the kitchen range to dry, and were finally baked in a cool oven, and when thoroly dry, and still hot, were well soaked in Sterling varnish diluted with about thirty per cent of benzine, and baked for about eight hours. This process was repeated three times, using only about ten per cent of benzine for the second coat and neat varnish for the third.



The powers that be objected strongly to the process, as they said the odor was more like that of the town of Cologne than the scent of the same name. The tubes still on the glass bottles were chucked in the lathe, and the ends trimmed off to length and trued up. The glass bottles were then removed with a hammer, as the card had shrunk to such an extent that that was the only available method.

After winding, the tubes and wire were

(Continued on page 135)

Experimental Electricity Course

S. Gernsback and H. Winfield Secor

LESSON 16.

ELECTROPLATING.

PART II—(Continued).

Zinc plating on iron, has rapidly developed into a large industry. Commercially, it is referred to as galvanized iron, the coating being a protection against rusting. Most of the zinc coating processes in vogue in the United States employ soluble zinc anodes, while Cowper-Coles, in England, uses insoluble, (lead), anodes, in an electrolyte containing 35 ounces of zinc sulphate, ($Zn\ SO_4$, $7\ H_2\ 0$), and 0.1 ounce sulphuric acid, (specific gravity at 1.84), per gallon of water.

A very good zinc plating solution is obtained, according to Foerster, by dissolving 200 grammes pure zinc sulphate, (free from iron), 40 grammes glauber salt, 10 grammes zinc chloride, and 0.5 gramme boracic acid, so as to get 1 liter of solution. With current densities of 0.005 to 0.02 ampere per square centimeter, good dense deposits up to 0.05 mm. thickness are thereby obtained at temperatures between 18° and 50° centigrade. The method of producing the zinc coating by electrolysis has the following advantages over the old dipping process; electrolytically deposited zinc, when properly applied, is denser, tougher, more uniform and more resistant against corrosion.

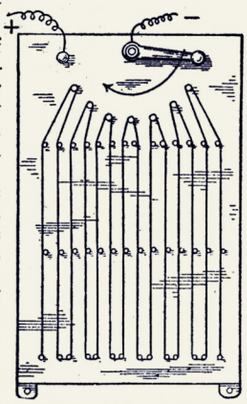


Fig. 6. A Plater's Rheostat.

Electroplating on aluminum is quite difficult, owing to the thin invisible film on the surface, (oxide or hydroxide film), which persistently refuses to be eliminated from the base metal itself. Unless great care and special cleansing baths are employed, the coating on aluminum will not stick for any length of time. The film of oxide is best eliminated by using a soluble fluoride in the plating bath. Zinc adheres best of all metals to aluminum. Hence, aluminum should always receive a zinc coating first. If gold is to be plated on aluminum, the gold should not be deposited directly upon the zinc, as the gold will soon alloy with the zinc, and apparently disappear. For this reason, the zinc deposit is best given a copper plating and then the gold plate on top of it. The zinc plating solution has about 1% of hydrofluoric acid added to it, or the equivalent amount of potassium fluoride. Before depositing the gold coating on the copper plating, the latter should be well polished, as otherwise a large amount of gold will have to be deposited to give an even coating.

The reverse of electro plating is the electrolytic removal of a metallic coating from the surface of an article. This is generally carried out as an anodic reaction. The most important industry in this field is the detinning of tin scrap, which has assumed considerable proportions in recent years, as a consequence of the enormous growth of the tin can industry. While formerly only the tin scrap of the tin can factory, (a pure material consisting of sheet iron covered with tin), was treated; the treatment of tin cans, boxes, etc., which have been used, has recently been taken up on a commercial scale. Since they contain many impurities, these must first be very thoroly removed, (carbonized, etc.). *See "Standard Electrical Engineers Handbook."

The electrolytic process in this field is invoked for the purpose of removing the tin from the iron, so as to get both the tin and iron separate and pure. The iron is sold as scrap to open hearth steel works, etc., and must therefore be absolutely free from tin and in good condition. The process having been the most successful on a large scale, is that of Theo. Goldschmidt, in Essen, Germany. It is a secret process, and employs the scrap as anode in a solution of caustic soda. Recently (1906) detinning with chlorine, has entered into competition with electrolytic detinning. Detinning with chlorine may be considered as an electrolytic process only in so far as electrolytic chlorine is employed, while the products of electrolytic detinning are tin and iron; those of chlorine detinning are tin tectrachloride and iron.

In large plating establishments, wooden tanks are used, also porcelain bath tubs, in some places. For the best results the electrolyte should be agitated while plating is going on, and in some cases the articles are moved about, to make the deposit as evenly distributed as possible.

It is imperative that good ventilation be had for the carrying off of fumes from the cyanide or other acid baths and dipping solutions, for these are strongly poisonous and should not be permitted to choke up or stagnate the atmosphere, in which the plater is working. Wool clothes are the best as they are not attacked by acid. The arrangement of a large plating vat, with several anodes, is depicted at Fig. 3, the various articles being suspended between any two anode plates as shown.

In Fig. 4 is shown a fair arrangement of a small plating room. The building or room may have ordinary plastered or wood walls. The floor is best of concrete, or bricks, with wooden slat platforms a couple of inches thick placed in front of the tanks and sink. The plating dynamo and motor to drive it are indicated at P. D. The plating tanks containing the solutions are P. P. Dipping vats are at D. D., while the sink and drain boards are S., S. D., and T. is a table. Hot and cold water should be piped to all sinks and tanks if possible. The floor should drain on a slope from the various tanks, sinks, etc., toward the centre of the room. An exhaust fan in the wall or upper half of a window, as shown, produces a good draught to suck out the poisonous fumes. What the electro-plater pays for in settling his bills for electricity or in renewing his batteries, is the number of kilowatt hours consumed by him. The amount of work performed by him, i. e., the weight of metal plated out by him, depends solely upon the ampere hours, tables of the corresponding electro-chemical equivalent being given in handbooks and platers' treatises.

Since the electrical energy measured in watt-hours is the product of the volts and the ampere hours, it is evident that since there is no chance of saving any part of the "ampere hours" necessary for a certain amount of plating, the only possibility of reducing the energy consumption is by reducing the voltage at the plating tanks by a resistance connected in series with the dynamo and tank.

In practice it is usual to lacquer certain plated finishes as they are not capable of holding their lustre for any length of time. Lacquer can be bought ready to apply, both cold and hot lacquer being sold. Hot lacquer is applied by heating the plated object gently and then dipping it in the lacquer, or it may be applied by means of a brush. Chandeliers, ornaments, and numerous other articles dipped or plated are lacquered to preserve their lustre, after polishing. White lacquer is used on nickel, if applied. Nickel plated parts for electrical switch contacts should never be lacquered, as this forms an insulating coating.

LESSON 17.

STATIC ELECTRICITY AND STATIC GENERATORS.

ALL bodies in the universe are supposed to contain an electric charge, either negative or positive. The earth itself is charged negative and positively at different times, and the strength of the charge varies widely also. The charge residing upon various bodies is supposed to be in a neutral state, unless disturbed. If two dissimilar substances are rubbed, for example, the neutral condition existing on them is upset or disturbed, and when they are separated, an excess of electricity remains on one, while a deficit of electricity exists upon the other. The two independent bodies are then said to be electrically charged. This form of electricity is in a state of rest, as compared to the flow of current from a battery, or dynamo, and hence it has been named "static electricity." It is electricity in potential form, i. e., nearly all voltage, and but slight amperage. The body referred to above, as having the excess of electricity, is known as possessing the "positive" charge, and the one having the deficit of electricity, the "negative" charge.

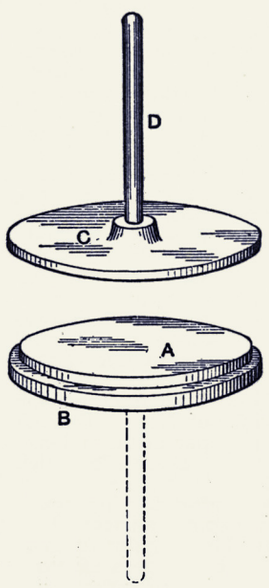
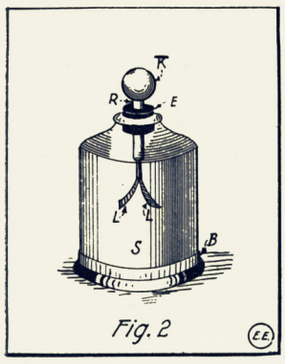


Fig. 1.

Hence, there are two forms of static electricity, viz., positive and negative. As an example, if a dry glass rod is rubbed briskly with a piece of silk the glass becomes positively charged with static electricity, and will effect an electroscope, which is described later on, or it will at-

tract bits of paper, etc. If a stick of sealing wax is rubbed with cat's skin or flannel, the sealing wax becomes negatively charged and the cat's skin or flannel positively charged. When the respective positive and negative charges are imparted each to a metal body, and these are brought into contact, the charges combine, and the electricity is restored to the neutral state, or equilibrium.



The Electroscope.

Bodies charged with positive electricity are indicated by the plus + mark. Negatively charged bodies are represented by the minus sign —. Bodies charged with positive electricity, repel one another, but attract bodies charged with negative electricity. Also bodies possessing a negative charge repel one another, but readily attract positively charged bodies. Hence, like charges repel each other, while unlike charges attract one another.

The commonest form of static electricity is found in nature, when lightning occurs during thunder storms. The voltage or potential of these discharges thru the atmosphere is enormous, probably reaching many million or billion. Thunder is the sound created by the passage of a lightning flash, and is the same as the noise of a spark discharge from a static machine or induction coil. Sound travels at the rate of 1090 feet per second, in ordinary air, and this explains why it is that the lightning flash is seen first, and, after a few seconds, the noise of the discharge or thunder reaches our ears. The velocity of lightning, if it approaches the speed of electricity travelling over conductors, which it probably does, is 186,000 miles per second. From this it is quite simple to compute the distance between yourself and a lightning discharge roughly. The time expiring between the first glimpse of the lightning flash and the thunder, expressed in seconds, and multiplied by 1090 feet, gives the distance over which the thunder has come.

The generation of static electricity in small quantities for laboratory study or experiment, electro-therapeutical purposes, X-Rays, etc., is accomplished by the use of frictional electrical machines, and influence machines, the Wimshurst static generator, belonging to the influence class.

Frictional static machines are not much used any more, except in small sizes, their principal defect being the exact and peculiar conditions surrounding the generation of static charges with them. They must have a very clear, dry air to work properly. The simplest frictional machine consists of a glass plate, rotating on an axle passing through its centre, and silk covered rubbers pressing against its sides as it rotates. Suitable combs or forks are provided around the plate to gather the electrical charge. Apparatus employed in experimenting with static electricity are Leyden jars or condensers, electrophorous, electroscope, etc., and experiments with these will be described presently. A static electric charge resides upon the surface only of bodies, and so a wooden sphere covered with tinfoil, or a hollow ball, is every bit as good as a solid one for the purpose. Hollow tubes are as good as solid rods, likewise.

Fig. 4. Leyden Jar.

A simple and inexpensive device for producing an electrostatic charge, is known as the electrophorous. A cut showing its arrangement is shown at Fig. 1. It consists of a thick disc, called the cake by some, composed of an insulating material, (non-conducting), such as ebonite, or a compound of resin. The resin cake A, is placed in a metal tray B. A thin metal disc C, termed the cover, and about the same size as A, and fitted with an insulating handle D, finishes the equipment.

The following manner is employed to generate an electric charge on the electrophorous: The resin or ebonite disc A, is rubbed briskly with a piece of silk or cat's skin, causing the disc to assume a negative electric charge. Now the metal disc C, is placed upon the plate A, which acts by electrostatic induction, to cause it to assume a positive electric charge. The positive charge resides on C, as long as it rests upon A only, and as soon as C is removed from the negatively charged plate, it becomes of zero potential, possessing no charge at all. If, while the disc C is resting upon A, it is touched by the finger of the operator, (which is the same as connecting it to earth), the charge residing upon A will repel negative electricity from C to earth, and attract a further amount of positive electricity to the disc C. Now if the finger is removed, the positive charge is retained on C, and may be removed if C is lifted off by means of the insulated handle D.

A Leyden jar or condenser may receive a charge by touching the knob of jar with C.

The electrophorous, above all else must be kept very dry, and produces best results in a cool dry atmosphere.

If the disc A is of glass instead of ebonite. and rubbed with silk, the glass becomes positively charged.

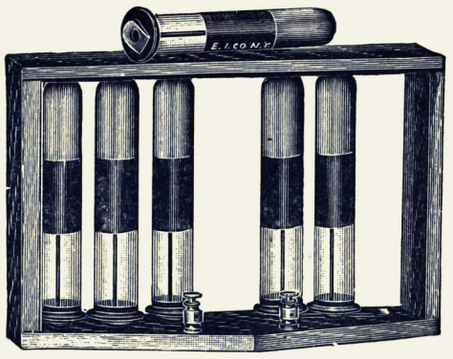
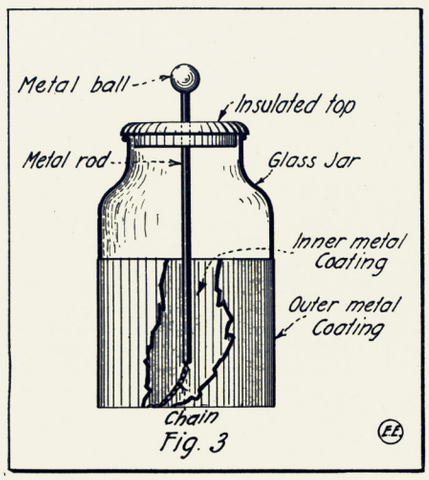


Fig. 5. Battery of Leyden Jars.

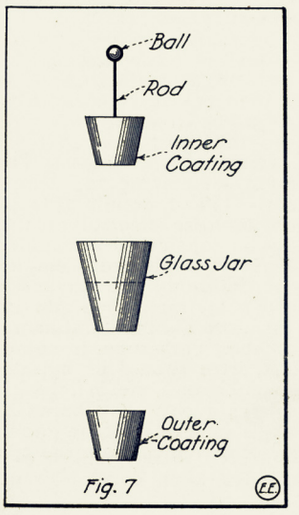
To ascertain the presence and polarity of static electric charges, use is made of a simple little instrument termed an electroscope. The electroscope is comprised of a glass vessel S, Fig. 2, fitted with an insulated top piece E. Through this top is placed a metal rod R, surmounted with a brass ball K. At the lower end of the metal rod is secured two pieces of gold leaf, hence this type is often referred to as the gold-leaf electroscope. The glass vessel sits in base B, which is sometimes of metal.



The action of the electroscope is as follows: If a body containing a static charge is presented to the brass ball K, the gold leaves within the glass ball will instantly diverge or fly apart. If no charge exists upon the body, the gold leaves will remain motionless, and close together. The polarity of a certain charge may be found by means of the electroscope also. First, a negative charge may be given the gold leaves LL. This may be accomplished by rubbing a glass rod with silk, and then presenting the glass rod to the ball on the electroscope. A negative charge is left in the electroscope, and the glass rod taken away from the ball.

Fig. 6. Leyden Jar Discharger.

The gold leaves diverge when first charged in the manner described, due to the charge remaining for quite some time in the electroscope. If now a negatively charged body is approached to the ball of the instrument, the leaves will be pushed farther apart, but if the body presented to it is positively charged, the leaves will collapse. It makes no difference which kind of a charge is given the electroscope, but if desired a negative charge can be imparted to the leaves by presenting a stick of sealing wax to the ball, having previously rubbed the wax with cat's skin or flannel. The electroscope is a very useful and important piece of apparatus in the realm of high potential or static electricity. A sensitive gold leaf electroscope will respond to the charged field existing about high voltage wires of transmission lines, etc., and such an instrument, for enabling electricians working around such wires, to tell whether they are "alive" or "dead," has been patented.



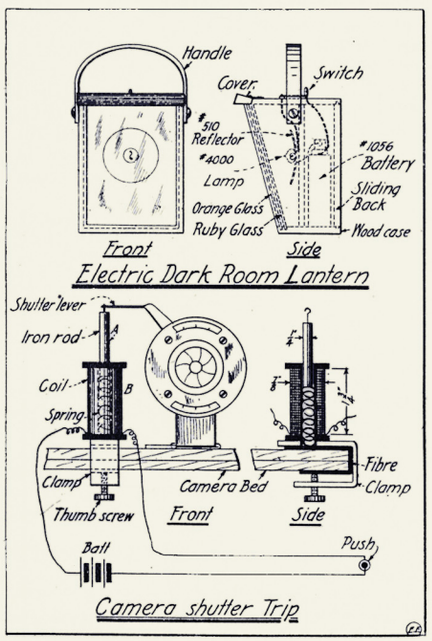
(To be continued)

THE CONSTRUCTOR

ELECTRIC DARK ROOM LAMP AND SHUTTER TRIP.

Photographers in general use oil or candle ruby lamps which are quite inconvenient, besides making a disagreeable odor and smoke. The electric ruby lamp is used in most commercial studios and how the amateur in this interesting field may construct his own battery type ruby lamp is shown in the illustration. It is made up of wood about ¼ inch thick, and grooved to take a ruby and an orange glass 4x5 inches or larger in the front. No white light must leak out at any point. A folding tin shield at the top serves to cover the small opening at the top of the glasses. Inside the cabinet is arranged a centre wood partition, upon which is mounted a miniature battery lamp receptacle, and a 3½ volt Tungsten lamp No. 4,000, or other type is mounted in same with a polished reflector No. 510. Back of the partition is arranged a 4½ Vt. flashlight battery No. 1056, etc., and it is best for longest life of same, to use instead, three Columbia 2½x6½ inch standard dry cells connected in series and wired up to the lamp by flexible twin lamp cord. A switch on top of the lantern cuts the lamp in or out and the whole device is wired in series.

It is often desired to operate the camera shutter at a distance from the operator for photographing birds, animals, the operator himself, etc., and a simple way to do this is by means of an electromagnet of the solenoid or suction type, as shown in the cut. Lengthy description is unnecessary and briefly, the attachment consists of an iron clamp with a thumb screw to secure it to the camera bed. The clamp should be fibre or felt lined to prevent scratching the bed. The magnet coil B is composed of a brass or fibre tube ¼ inch inside bore, fitted with two fibre or wood ends 1¾ inches

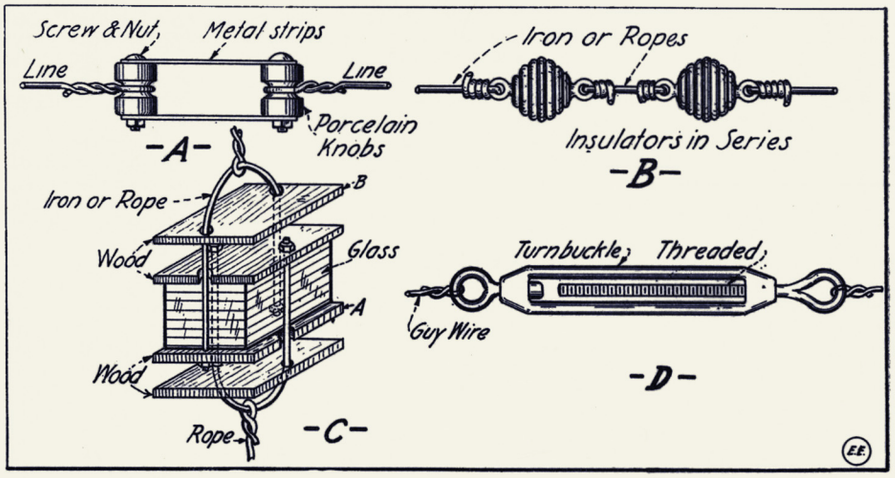


apart, and the tube after being covered with a layer of paper is wound full of No. 24 enameled magnet wire.

The two magnet leads can be then connected to any length of bell wire or stranded lamp cord desired, and for 50 to 75 foot circuits, 3 to 4 dry cells and a push button will operate the solenoid nicely and hence also the shutter. A spiral spring under the iron plunger A, serves to hold it up normally.

CONCERNING AERIAL INSULATORS.

Wireless aerials perhaps require better insulation from the ground and other adjacent conductors than any other ordinary electrical device. A few useful hints are illustrated in the sketch here shown, and at A, a simply made strain insulator is indicated. It consists of two metal strips, two porcelain knobs and a couple of machine screws with nuts. A couple of standard *"Electro"* ball strain insulators are connected in tandem at B, to increase the total insulation resistance, and five to six are often used in this manner. Porcelain cleats have been employed in the way here shown for radio receiving. At C, is depicted a novel form of strain insulator for high power work, and of the pattern employed at the (Telefunken) Sayville, L. I., Radio Station. It consists of several wooden pieces (for amateur construction) as perceived, and between the pieces A and B, glass plates may be utilized and this is the best and only practical way to use glass, i. e., under compression strain. An *"Electro"* turnbuckle is very useful for tightening up guy wires and the appearance of this device is seen at D. They are worth 30 cents.



MOUNTING DETECTOR CRYSTALS.

Set the crystals in a detector with a heavy grade of tin-foil, packing it in tight. This answers the same purpose as setting it in molten solder and is more easily done. I am a subscriber to the *Electrical Experimenter* and think it fine for amateurs.

Contributed by

RALPH E. BROOKS.

E. A. GLATFELTER HAS WIRELESS STATION.

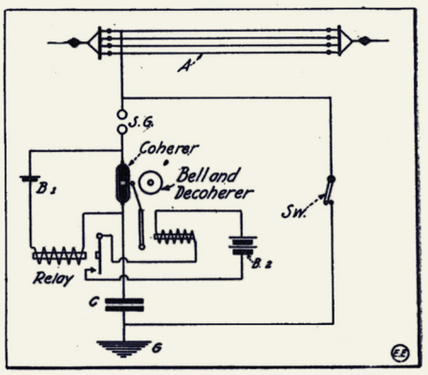
A wireless telegraph station erected by E. Abraham Glatfelter, of the York High School faculty, at his home near Nashville, Tenn., has proven a success. In a very distinct manner Mr. Glatfelter is able to detect press news sent to the United States from London, it is claimed.

Each night at ten o'clock he is able to get the standard time sent out from the government wireless station at Arlington, Va.

The aerial is 315 feet in length, the largest in this part of the State, Mr. Glatfelter states. The latter holds frequent conversations over the wireless system with H. A. Miller, who has a station erected at his home at Elmwood, York, Pa.

A WIRELESS STORM DETECTOR.

The various parts making up the electric storm detector are an aerial, a short-circuiting switch, a spark-gap, a coherer, a relay and a battery, a bell (which also acts as a decoherer) and battery, a condenser and an earth connection. This storm detector is used in a great many central electric stations to give warning so that a suddenly increased load can be arranged for ahead of time. The figure shows the diagram of connections of these parts, which are described below. Antennae, similar to the more simple ones used in connection with wireless telegraph outfits. The short-circuiting switch is normally kept in the "open" position. After the alarm bell has begun to ring continuously it is closed to



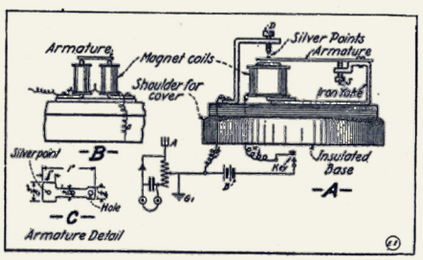
protect the apparatus from heavy surges and to silence the bell. The spark gap consists of a simple gap with spherical terminals placed approximately 1/64 inch apart. The purpose of this gap is to prevent those surges that are induced in the antennae by the radiations emanating from wireless telegraph stations, but which are very weak as compared to

the lighting disturbances, from flowing thru the remainder of the apparatus, and thus causing a false alarm. The coherer is similar to the type used in the early days of wireless telegraphy. In brief, it consists of a short section of glass tube of small bore loosely filled with nickel-silver filings. These are connected at each end to the outside circuit by German silver plugs. The action of such a type of coherer is well known and needs no further explanation. It is the same type as the "Electro" precision coherer.

The most effective type of alarm is an audible one, of which the simplest form is a bell. However, as a bell requires a greater amount of current for its operation than that increased amount of battery current which is caused to flow in the coherer by a high-frequency discharge, some magnifying or relay device must be used. The relay employed is one of the ordinary telegraph type, preferably a 100 ohm or higher resistance E. I. Co. polarized type, and the battery B_1 is a dry cell. The bell is one employing single-stroke connections, and is of a size sufficient to be easily heard thruout the system operator's office. (The coherer, relay, condenser and bell are located in this office.) The bell has its own supply battery of dry cells B_2, and is controlled by the secondary contacts of the relay, as shown in Figure. As the low-resistance condition into which the coherer is thrown by a high-frequency discharge is permanent until the tube is smartly jarred the bell is mounted so that its clapper will strike the tube, and thus perform the twofold function of bell and decoherer. (It is evident that the tube must be decohered, otherwise it would not show the effect of a later high-frequency discharge.) The condenser is an ordinary one, and is inserted in the earth wire to prevent stray direct current from flowing in the apparatus.

A "HY-TONE" RADIO TEST BUZZER.

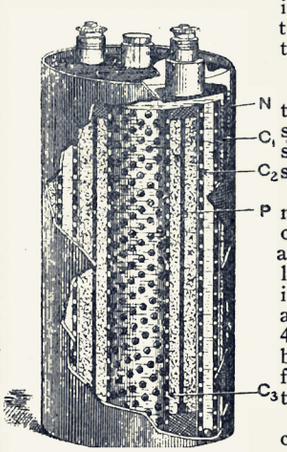
An extra high tone radio testing buzzer is always in great demand for adjusting the detector to its greatest sensitivity. Such a buzzer is readily constructed from a piece of clock spring for the armature (see figure at C); a piece of 1/16 inch soft iron strip, ¼ inch wide, except where it widens out to accommodate two E. I. Co. telephone receiver spools, which are purchased unwound at 10 cents each. They should be wound full of No. 26 enameled magnet wire, and the whole buzzer is connected in series,



i. e., the coils, the armature and contact screw D. This screw should be faced with a bit of silver wire, and also opposite it on the armature, another piece of silver should be secured, by riveting preferably. The connection of the testing buzzer to a radio receiving set is shown in the diagram at A. View B, is given to simplify the mounting scheme for the two receiver bobbins on the iron yoke piece, and they are easily held in place by a couple of wood screws into the base. A cover of metal may be made from a baking powder tin and slipped over the buzzer. The clock spring for the armature is procured from any watchmaker, and its tension is adjustable by the screw S. A couple of dry cells or a flashlight battery and a No. 1118 strap-key complete the outfit. They sell on the market at $2.50.

A NOVEL STORAGE BATTERY.

Some interested attaches to the method used in the construction of the "Phoenix" accumulators which have recently been introduced into England. They have been manufactured for some years in Paris, and the experience there gained has resulted in the production of a strongly-built accumulator, says "The Electrician," London. The cell, as seen by the accompanying illustration, is circular in shape, and the two plates are concentric cylinders. The negative plate consists of a cylinder of lead, N, situated between the walls of the ebonite container and an inner perforated cylinder, C_1, of ebonite, the intervening space being packed with the negative active material. The positive plate consists similarly of a lead cylinder, P, between two perforated ebonite cylinders, C_2, C_3, the intervening space being packed with positive active material. A special porous envelope is placed over the perforated cylinder to prevent the egress of any active matter, while allowing a free passage to the electrolyte, which fills the remaining portions of the cell. A small triangular-shaped framework at the bottom keeps the positive and negative tubes in position, and the container is sealed with an ebonite cover. It is claimed that with this construction a high capacity, combined with a long life, is obtained. The specific capacity is stated to be 16.4 watt-hours per pound of total weight at the ten-hour rate.



A SHORT WAVE RECEIVING JIGGER OR LOOSE COUPLER.

(Continued from page 131)

given two more coats of varnish inside and out, and yet again baked. Wooden ends were finally fitted, and the jigger completed, as shown in the drawings.

It is rather a difficult job to find bottles which are not slightly conical, but some jars used for preserves have not this objection.

I had previously tried using card tubes of the postal tube type, but found that during the process of baking they warped and twisted out of all shape, and that the only method to keep them true was to mount them on a mandrel which had to be constructed in some manner that it could be withdrawn when required.

The bottle dodge would not do for a manufacturer, as it would be an expensive item to smash up a bottle for each tube for a repetition order of, say, 100 jiggers.

The studs for the tuning switches were made from ordinary 5/32nds in. by ⅝ in. brass, round headed Whitworth screws, the holes being tapped into the ebonite, the screws tightly driven home, and nuts screwed up on the underside. The round tops of the screws were then filed off flat, so that a fairly large contact surface was left, whilst the rounding edges make a nice chamfer. Subsequently, a second nut was added to each stud to connect the leads with.

The levers are made of 3/32nds in. sheet brass with ebonite handles.

The primary coil is made to slide on a wooden rod which is held in place on an upright with a wooden dowel at the primary end, and the wooden disc in the end of the secondary coil is mortised to the same wooden rod, and that end is held in place by a single brass screw thru the wooden upright. This completes the description.

Now for a few results:

All the principal European coast stations can be heard very clearly and Unshant, and some of the other French stations have been heard without any special adjustment of crystals, etc.

Even Norddeich and Paris time signals have been read on this jigger without a condenser in parallel with the primary on an aerial with a fundamental wavelength of but 230 metres. Norddeich is heard when the jigger is tuned to about 430, and Paris when tuned to about 470 metres; and both can be tuned out by adding or deducting about two or four turns on the tuning switch, showing that it is a true harmonic.

Amateur signals are picked up which cannot be heard on any big jigger, and curiously, I can get stations with shorter waves than my aerial fundamental without a condenser in the primary circuit.

Since the drawings were made and the above description written I have added a little condenser, consisting of a brass tube ⅝ inch diameter sliding in another brass tube 23/32nds inch bore, each being 4½ inches long. The larger tube is provided with brass lugs which are screwed to a block of ebonite, which in turn is screwed to the base of the jigger. The smaller tube is mounted on a bit of hardwood, which forms both a handle at one end and a guide at the other, so that the inner tube itself can be withdrawn, while the guide remains in the outer tube. The hardwood core was first turned up about $\frac{1}{16}$ inch less than the inside diameter of the tube. The wood was then thoroughly baked to shrink it as much as possible, then it was coated with paper and "Bakelite," and again turned down till the tube could just be pushed on.

The flexible lead was then passed thru the handle, and the bare end fished up thru a hole in the brass tube to which it was soldered. Then the two ends where the tube did not cover the wood were made up even with the tube by wrapping round more paper and "Bakelite" and finally an external covering of "Bakelite," and paper was applied over the whole tube till the desired thickness was attained.

I have not measured the capacity of this little condenser yet, but it seems to be considerable, as a very slight movement will throw a station in or out of tune.

The strongest signals are obtained from most stations with about half the full capacity of the condenser, and it is never necessary to use more, as the secondary inductance is amply sufficient to tune in waves up to 800 metres, while the primary requires a lot of condenser, in parallel to get that wave.

I have taken every reasonable precaution that I could foresee in making this jigger, and must say I feel amply repaid by the results obtained.

A Novel Electric Christmas Tree

By Frank H. Broome

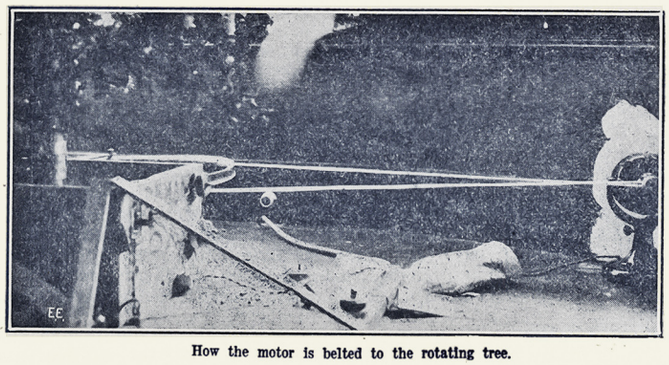
CHRISTMAS is near. What kind of a tree are you going to have? The same old-fashioned one as past years with the wax candles on? Try a little something up-to-date, with the surplus material in your scrap-box. Why not have a revolving tree with flashing lights and a miniature village under it? You are not using your electric fan motor now and if you can't get any other reducing arrangement, take your bicycle (which is also useless now) apart, and use that in the following way.

The Electric Village under the Xmas tree.

The other necessary materials are easily obtained at a small cost, if you have not them on hand, and they are equally easy to assemble.

The first thing to obtain is a good size base, about four by six feet, as this prevents damaging the floor and also furnishes a convenient place for switches. If you happen to be an amateur draughtsman you may utilize your drawing board by turning it upside down. A strong box is the next thing to be procured. Switches can also be fastened on one end of this, making a little convenient switch-board in one corner, and the cover should be taken from the box and the latter put on one side while the bicycle is being attached.

The front fork is removed from the head by loosening the nuts at the top. The two wheels are also removed, the tire being taken from the back wheel and the latter put in the front fork. A large sprocket is also needed but it will be better to buy this for a few cents, second-hand from a bicycle dealer, rather than go to the trouble to take it from the bicycle. This sprocket is fastened to a block about 4 in. x 4 in. x 1 in., which in turn is fastened to the bottom of the tree with screws so that it can be removed.



How the motor is belted to the rotating tree.

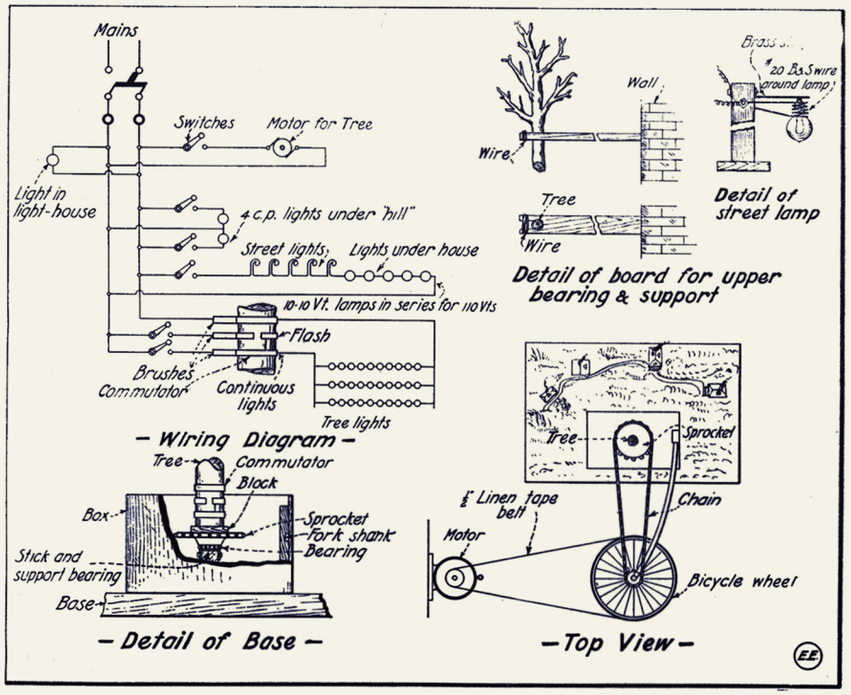
The bicycle parts are then fastened to the box, a hole, large enough to admit the shank of the fork is bored in the side of the box at a point two-thirds up the box, a hole, large enough to admit the shank of the fork is bored in the side of the box at a point two-thirds up on the box and as close to the right end as possible. A slot about two inches wide and twelve inches long is cut in the same end of the box parallel to the bottom of the box; the centre line of the slot being the same as that of the hole.

The box is then fastened to the board at a point well to the rear so that there will be room in front for the miniature village. The shank of the fork is then put through the hole in the box and fastened by means of a piece of wood inside the box.

A bearing for the bottom of the tree is the next thing to be considered. A suitable ball-bearing for this can be obtained at a hardware store for about ten cents; it being in the form of a large ball-bearing castor, with four holes, and screws to fasten it on to the furniture. The wheel of the castor is removed by filing the head off the rivet holding it in place and knocking out the rivet; the wheel is not used.

A piece of wood, the length of the width of the box (inside), about three inches deep and just wide enough to allow the sides or prongs of the wheelless castor to fit over it, is then obtained. A little adjusting, upon which a large part of the success of the apparatus depends, is now necessary. The bearing is fastened on to the bottom of the block, and fastened to the sprocket wheel by means of screws through the four holes. The prongs of the bearing are put over the afore-mentioned stick and the latter put at such a height in the box that the two sprocket wheels (the one on the box and the one on the wheel) are at the same level and the stick secured in place by nails. The chain is now put on the sprockets and the bearing adjusted to such a position along the stick that the apparatus runs true and easily. The hole in the prongs of the bearing is marked on the stick and a hole bored through the stick to receive a bolt, cotter, or a nail bent over, etc., to hold the bearing in place.

A stick of sufficient length to be fastened to the wall is slotted at one end to go around the tree near the top which holds the tree in position and acts as the upper bearing.



This practically completes the mechanical part, now for the electrical. If the hill effect is used, lights can be put under the "hill" and the houses put over a hole cut in the asbestos forming the hill. In this case two porcelain wall-sockets are conveniently located and four candle power lights used in same. It is better to have each of these lights with independent switches so that different effects can be obtained. Those houses that are on the level should have small lights under them and should be conveniently located, as should the street lights. The construction of the stands for the latter may be seen from the sketch or may be made as the maker sees fit. For these and the houses on the level ten 10-volt lamps are used in series on 110-volt A. C. or D. C. line. If storage battery or dry cells are used the lamps must be in parallel.

(Continued on page 138)

HOW-TO-MAKE-IT DEPARTMENT

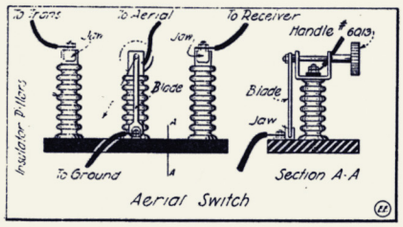
This Department will award the following monthly prizes: FIRST PRIZE $5.00; SECOND PRIZE $2.00; THIRD PRIZE $1.00. The idea of this department is to accomplish new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best ideas submitted a prize of $5.00 will be given; for the second best idea a $2.00 prize, and for the third best a prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings.

FIRST PRIZE $5.00.

HIGH TENSION AERIAL SWITCH.

By John Chambers.

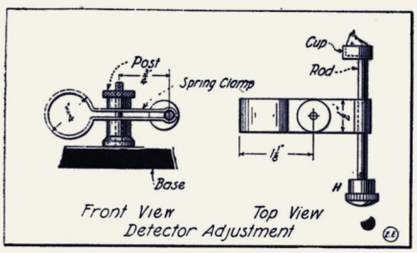
MANY amateur radio stations waste considerable energy thru improper design of aerial switching devices, such as those mounted on untreated wood bases or those whose metal portions are entirely too close together, permitting undue leaking of the high voltage current across such parts. The switch here outlined is on the order of that supplied by one of the commercial Radio Telegraph Companies, and as perceived, the rotating blade and 3 jaw contacts are very well insulated indeed by being mounted at the



extremities of ribbed hard rubber, fibre, porcelain or bakelite columns. High tension cable leads directly to the metal parts of the switch as seen, and these are very well supported in air by strings, etc. The sketch explains itself pretty well and the blade has 3 positions: "to sending" or "receiving instruments" and "to ground" for lightning protection. The metal parts located at the top of the ribbed insulators, which may of course be antenna "Electrite" type, as supplied by the E. I. Co., should be fastened by clamps, et cetera, at the top of these insulators and not having bolts running thru them. If made of hard rubber or fibre, the switch gear can of course be held easily by machine screws tapped into the columns for a half inch or so.

An Efficient Detector Adjustment.

The illustration indicates an easily made spring clamp to be secured on a binding post and which effectually holds a brass rod and cup of standard pattern. The clamp has an enlarged portion ¾"



in diameter, and it can be made of about 3/64" phosphor bronze, copper or brass stock. A hole is drilled thru it crosswise and it is then slipped over a binding post stud, as shown, permitting any pressure desired to be put upon the cup rod and handle H. As will be evident the pressure is nicely adjustable so that the rod and cup will turn rather stiffly. Note that the cup is eccentrically mounted on the rod to improve the adjusting features.

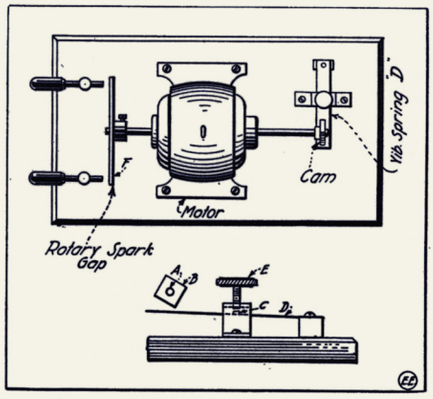
SECOND PRIZE $2.00.

A SYNCHRONOUS ROTARY SPARK GAP FOR SMALL COILS.

By Earl Emendorfer.

As all experimenters know, the wireless law prohibits the use of wireless instruments that make the radiation of pure, sharp waves impossible. Under this ban comes the stationary spark gap. The amateur now has his choice of the rotary or the quenched gap, and, of these two, the rotary is the only one the experimenters with the small coils can generally use. Then, again, the ordinary rotary cannot be used unless there is delicate balance between the aerial and condenser circuits. The synchronous rotary gap is the only one left for him to use, and the one I will now attempt to describe is simpler than any that have come to my attention so far.

A description of "how it works" will now be in order. On one end of the motor shaft A is an ordinary four-sided nut B. This nut will be the cam that operates the contacting device. On the other end is a zinc disc F. In operation, the cam opens and closes the primary of the coil, which consequently passes the sparks between the rotating disc and the two fixed electrodes mounted before it.



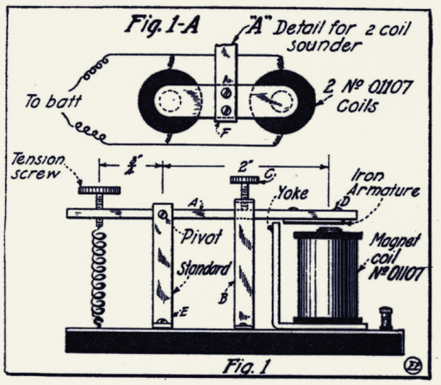
The size of the base will depend on the size and type of motor used. The motor should have considerable power and speed. One end of the motor shaft is threaded so as to hold the four-sided nut B firmly. The other end should be threaded to accommodate the disc and the nuts to secure it to the shaft. Now take the vibrator from your coil and mount it on a block of wood of such thickness that the nut on the shaft will trip the blade D of the vibrator when the block is mounted on the same base as the motor. After the vibrator is mounted it may be regulated nicely by the adjusting screw E, and C is the platinum contact on the vibrator spring.

The disc of zinc on the other end of the shaft is about 4½ inches in diameter, ⅛ of an inch in thickness and should run as true as possible. It is preferable to have the disc insulated from the shaft. In front of the disc are the usual hard wood or rubber standards from which project the stationary zinc electrodes.

THIRD PRIZE $1.00.

MAKING A TELEGRAPH SOUNDER.

A telegraph sounder can be made from a couple or even one of the *"Electro"* magnet windings, such as the No. 01107 type, of 20 ohms resistance each. If one magnet coil only is utilized the magnetic circuit of the sounder or relay is made twice as effective by arranging a yoke of ⅛" by ½" wrought strap iron, as shown in the sketch. This serves to help the



magnetic circuit complete itself thru the iron armature mounted on the brass sounding bar A, of ¼" by ⅜" stock. This bar A, is made about 3¾" to 4" long and is pivoted as shown in an upright or trunnion fork E. The upright B is U-shaped and carries the upward stroke-control screw C. The downward stroke may be made adjustable by placing a thumb-screw in the bar at D, instead of the second machine screw for holding the armature of soft iron ⅛" thick, by ⅜" wide by 1" long approximately. This gives us a 20 ohm sounder.

For making a two coil, 10 ohm sounder, the detailed sketch at Fig. 1, A is referred to, and here a piece of ⅛" soft iron F, is fastened to the brass sounder bar A, as perceived and the both coils exert a pull on this armature. The two magnet coils are of course mounted on a soft iron yoke about ⅛" thick by ½" wide by 2½" long. The two 20 ohm coils are connected on parallel to give 10 ohms joint resistance. In series they yield 40 ohms resistance of course. Three to four dry cells work this sounder nicely over short telegraph lines.

Contributed by CARL S. DRESS.

The size of the high tension condenser will be determined by the number of interruptions per unit length of time. Consequently the speed of the motor must be as uniform as possible. Needless to say the primary condenser should be shunted across the vibrator as it was when mounted on the coil. The rotating zinc disc may be slotted to imitate a regular rotary gap, but the teeth must be proportioned to the primary circuit cam frequency. Four teeth would be suitable for a four-sided cam, etc. Also more teeth on the cam may be very well employed and the spark frequency is variable by placing a rheostat of No. 5000 *"Electro"* type in the motor circuit, so as to vary the speed of same.

Wrinkles—Receipts—Formulas—Hints

By S. Gernsback.

Under this heading we will publish every month useful information in Mechanics, Electricity and Chemistry.
This department will be edited monthly by Mr. S. Gernsback.
We shall be pleased, of course, to have our readers send us any recipes, formulas, wrinkles, new ideas, etc., useful to the experimenter, which will be duly paid for, upon publication, if acceptable.

FORMULA NO. 5.

Preparations for Preserving Anatomical and Natural History Specimens.

(1) *Bones and Skulls.*—The best way is to boil them for some hours in water containing potash. Next wash them in fresh water, and lay them out to dry.

(2) *Fishes and Reptiles.*—All soft anatomical specimens should be preserved in proof alcohol. It is very important to first make very carefully an incision in the under part to facilitate the introduction of the spirits. This prevents the putrefaction of the internals.

(3) *Larvae of Insects, Spiders, and other small objects.*—The following solution will be found very valuable: 1 oz. *glycerine;* 1 dr. *common salt;* 1 dr. *saltpeter;* 8 ozs. *dist. water.* Mix well together. When wanted for use, take two ounces of pure alcohol and add one ounce of the mixture; shake well and filter.

(4) *Salamanders, Young Frogs, Tadpoles, etc.*—1 lb. of *sulphate of zinc;* 2 dr. of *burnt alum.* Mix well together.

(5) *To Bleach Bones and Skulls.*—Dip the specimen for a few moments in a boiling solution of 1 lb. of caustic soda in 1 gal. of water. (Be careful.) Rinse thoroughly in water. Rub with fine pumice stone. Then expose until completely whitened to the vapor of burning sulphur, largely diluted with air. After this rinse in warm water.

(6) *Fluid for Anatomical Preparations.*—Dissolve four parts of chloride of tin in 100 parts of water, to which three per cent. of muriatic acid has been added.

(7) *Another.*—Dissolve five parts of corrosive sublimate (poison) in 100 parts of water to which two per cent. of muriatic acid has been added.

These two fluids are used by immersing the objects therein, in close vessels. Formula No. 7 is apt to render animal substances very hard.

(8) *Preparation for Taxidermy.—Solution.*—1 dr. of *corrosive sublimate;* 2 dr. of *spirit of salt.;* 6 ozs. of *spirit of camphor.* Dissolve the sublimate in the spirit of camphor and then add the spirit of salt (hydrochloric acid). Apply with a brush or sponge to the inner side of the skin before stuffing.

(9) *Preparation for Taxidermy.—Powder.*—2 drm. of *white arsenic;* 2 drm. of *corrosive sublimate;* 1 oz. of *nutgalls;* ½ oz. of *capsicum in powder;* ½ oz. of *sal ammoniac;* 6 dr. of *camphor in powder.* Mix well together.

(10) *Preservative Compound.*—4 ozs. of *powdered oak bark;* 3 ozs. of *powdered burnt alum;* 2 ozs. *of sublimate of sulphur;* ½ oz. of *powdered camphor;* ½ oz. of *oxymuriate of mercury.* Mix well. Used for dressing the skins of reptiles before stuffing.

S. G.

DESIGNING ON GLASS WITH ALUMINUM PENCILS.

By means of a pencil of aluminum indelible characters may be written or drawn on glass or porcelain, and when treated with hydrochloric acid the surface covered by the characters becomes etched. When the characters are not etched, but simply burnished, they exactly resemble inlaid silver. This property of aluminum was discovered by a Swiss scientist.

It is indispensable first to remove every trace of grease from the surface to be ornamented by polishing with chalk, else the aluminum will not take hold. As the effect is produced only on substances containing silicic acid, it has been suggested that an aluminum pencil would be an unerring detector of false diamonds. Magnesium, cadmium and zinc act in a similar manner, but their traces readily oxidize.

A NOVEL ELECTRIC CHRISTMAS TREE.

(Continued from page 136)

A commutator is needed on the tree, to conduct the current to the lights. This is easily made as seen from sketch, by fastening narrow bands of copper around the tree and having copper brushes make contact on them. In order to have the lights flash, a third band is put on, this band not making a complete ring around the tree.

The construction of the hill is also easily seen from the photo. Small sticks are fastened from the box to the base and covered with asbestos sheet, small pieces of tin being used unde the sheet to shape with. Holes are left for the houses which are easily obtained from any toy store for about 25 cents per set. The windows and doors are cut out with a sharp knife and tissue paper glued behind them. Asbestos should be put under all switches and all wire should be No. 14 asbestos or rubber covered or reinforced lamp cord.

It is well to have the light house with a separate light which should flash if possible. A mirror makes a good lake and cotton covered with artificial "snow" banked around the houses makes equally good "snow." A scenic background, either painted or cut from a book adds materially to the effect. The complete connections are given in the sketch and also some details of construction.

By changing the commutator and connections of lamps on the tree various effects can be produced, such as having the lights "run" in the opposite direction to that in which the tree is turning or have the lights "run" up and down the tree. A small electric railway adds much to the effect, but these and other features are left to the maker.

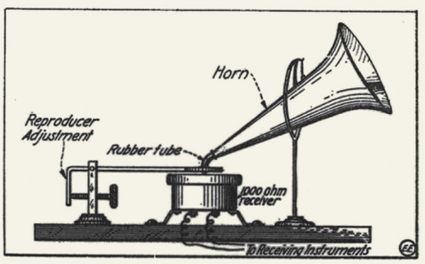
A reducing arrangement other than the bicycle parts may be used, but this seems the simplest to the writer and has very slight friction on account of the ball bearing of the bicycle wheel, and as the chain is a positive drive, little is lost in slipping of the belt except on the shaft of the motor. The size of the pulley on the motor can be used to vary the speed of the tree, the speed varying directly as the size of the pulley. One-half inch linen tape makes a good belt as it has a fairly large surface and less slipping results than if cord is used.

Test messages of wireless telegrams sent in Peru with five-kilowatt power passed the Andes Mountains from 14,000 to 20,000 feet high.

Wireless telegraphy works better on the Pacific than on the Atlantic Ocean and experts are trying to find an adequate explanation for the fact.

AN ACOUSTIC RADIO AMPLIFIER.

Amplifying weak radio signals by acoustic principles is carried out by arranging a phonograph horn and the reproducer so that the sapphire needle of same rests very gently on the diaphragm of a sensitive wireless receiver, some-



what as our illustration shows. This idea was first described by Stanley Hyde in the technical press, a couple of years ago, and it may be of interest to our readers at this time, as so much attention is now being devoted to amplifiers of one kind or another for boosting the received radio signals. With fairly strong signals the sounds reproduced in the phonograph horn can be read clearly at some distance from it.

THE FOLLOWING BACK NUMBERS OF THE "ELECTRICAL EXPERIMENTER" CAN BE SUPPLIED AT 5 C. THE COPY WHILE THEY LAST:

DECEMBER-1913.
Only a part of the valuable articles therein:
Lecture on Audion Amplifiers, by Dr. Lee De Forest.
Small Electric Lighting Plants.
Modern Radio-Telegraphic Receiving Sets.

FEBRUARY-1914.
The Radioson Detector, by H. Gernsback.
Currents of Ultra High Frequency and Potential.

MARCH-1914.
A Hertzian Wave Relay for Operating Tape Recorders.
Wireless Receiving Sets Without Aerial or Ground.
The Construction of a 3,000 Meter Professional Type Loose Coupler.

APRIL-1914.
Sources of Energy for Radio Transmitters.
Design and Construction of Radio Antennae—Part 1.
A Simple Radio Break-in System.

MAY-1914.
Design and Construction of Radio Antennae—Part 2.
Small Water Motors and Dynamo Drives.
Experimental Electro-Physics.

JUNE-1914.
The Detectiphone and Radio Amplifiers.
Small Quenched Spark Gaps. (Construction.)
Wireless Receiver Design.
Modern Electro-Therapeutics.

JULY-1914.
The Speaking Arc-Light and How to Build It.
A Miniature Vacation Type Radio Receiving Set.
A Laboratory Switchboard.
Radio Transmission and Weather.
The Reduction of Obesity by Electricity.

AUGUST-1914.
An Efficient Wave Meter and How to Build It.
Selenium Cells and How to Use Them. (By a Specialist.)
The X-Ray and Allied Apparatus.
How to Make Selenium Cells.
A Simple Radio Amplifier.

SEPTEMBER-1914.
Measurement of High Voltages with Direct Reading Curves.
Wave Length of Loose Couplers.
Aerial Mast Construction.
Making Simple Volt and Ammeters.
The Sayville Wireless Station. (Telefunken.)

Also for other much desired data and information, we refer the reader to the following excellent books:
For Induction Coil, Tesla Coil and Wireless Transformer Data, see "Construction of Induction Coils and Transformers," by H. W. Secor, 25c. (Third Edition now ready.)
"Induction Coils," by Kurt Stoye, 25c.
"Induction Coils," by Norrie, $1.00.
Radiotelephony, see "The Wireless Telephone," by H. Gernsback, 25c.
Making Radio Apparatus, see "How to Make Wireless Instruments," 25c.
Diagrams for Radiotelephony or Telegraphy, see "Wireless Hook-Ups," by G. E. Rudolph, 25c.
A list of other good books is given in the E. I. Co. catalog No. 14, postage 3c.

The E. I. Co. Laboratory at New York

THE radio and electrical laboratory maintained at the New York City factory for testing and research work along these lines is quite complete, and here a large number of the well known "Electro" instruments have been born and developed. Besides this laboratory, located on the second floor of the main factory and office building at 233 Fulton Street, another special laboratory is maintained by Mr. H. Gernsback, President and Chief Engineer of the Company, and this is located on the fifth floor at the back of the building. Electro-chemical and battery research work is performed here, and the room abounds with bottles of all sizes, graduates, hydrometers, voltmeters and ammeters, crucibles, et cetera.

Mr. H. Gernsback is a specialist on electric batteries of all kinds, having spent a number of years in special research along these lines, both in America and abroad. He is seen in our photo, Fig. 1, experimenting with a special radiophone spark gap. This view shows only a small corner of his private laboratory. Both direct and alternating current are available, and also the wireless antenna has a separate lead-in available for this room.

In our illustration at Fig. 2, the laboratory on the second floor just mentioned is seen, with Messrs. S. Gernsback and H. W. Secor, measuring the length, frequency and damping of etheric waves set up by a special high frequency machine of the Rosenthal type. This laboratory is equipped with both A. C. and D. C. and the radio antenna, supported from an eight story building next door, has its principal lead-in brought down to this room. The lead-in and ground wire from roof to water-pipe in basement is of No. 4 B. & S. solid copper.

A ½ K. W. radio transmitting set, employing No. 8050 coils and electrolytic interrupter is set up in the station for testing work and various experiments. Voltmeters and ammeters measure the primary input to the sending set, and a hot wire ammeter measures the output to a "phantom" aerial, composed of resistance, inductance and capacity; adjustable as desired. Choke coils are used on the secondary terminals of the transformer coil to prevent the high frequency condenser discharges or surges from passing back into the transformer, which wreak havoc in many cases to the primary circuit and to the transformer windings themselves. These secondary choke coils also help to increase the radiation current in the aerial by choking back the high frequency oscillations from the transformer, as has been proved by direct measurements; the increased radiation occasioned by their use amounting to as much as 15% in some cases.

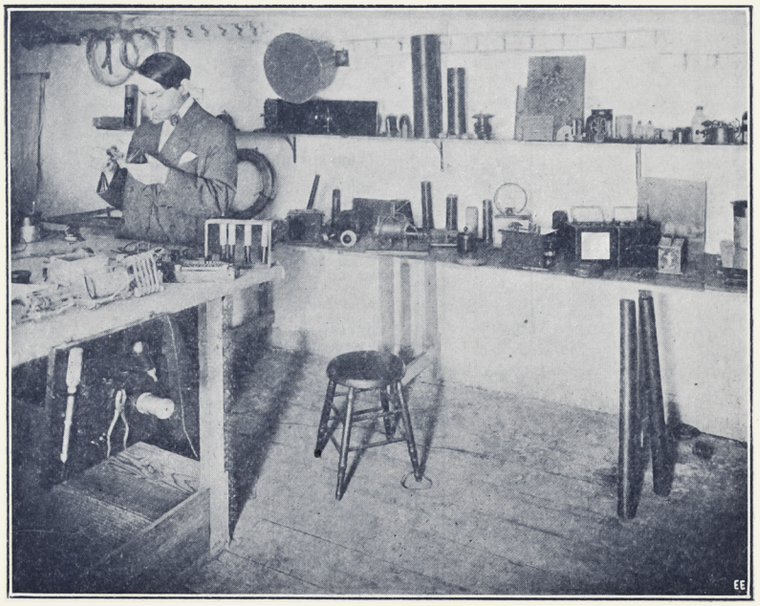


Fig. 1. Special Research Laboratory on Fifth Floor.

The switch-board, of hard rubber and supported by hard rubber rods from the left-hand wall as seen in our illustration, contains the meters above mentioned.

The receiving apparata is changed frequently for the purpose of experimenting with new or improved instruments, detectors, hook-ups, etc. In general, this invariably includes a loose coupler and loading coil No. 8487 type; several detectors, such as the No. 7777, 9300 Radioson, etc.; head 'phones of high resistance, blocking or fixed condensers, No. 10,000 improved type, variable condensers in both primary and secondary circuits of the loose-coupler, including a series ground V. C. with cut-out switches; for tuning in shorter waves than those receivable on the antenna proper, which has a fairly long natural period in view of its great height. This antenna by the way is made up of 4 strands of "antenum" phosphor bronze 7 strand cable, spaced about 4 feet apart, and a No. 10002 Electrite aerial strain insulator is placed at both ends of the strands. The lead-in wire is brought down the outside of the building on large porcelain knob insulators. The ground wire is not insulated. The lighting switch is placed outside the laboratory window as required by the Fire Underwriters. Practically all the radio stations in the east have been "picked up" at this laboratory. This laboratory also serves as a testing station for the manufactured products of the Company. All kinds of high voltage and high frequency experiments and tests are conducted here, and all necessary meters are on hand or available, including Weston volt and ammeters, Resistance bridge or ohmmeter, Telephone receiver sensitivity bridge or coupler with 3 foot adjustable coupling, Wave Meter, etc.

Fig. 2. General Testing and Research Laboratory on Second Floor.

The Engineering Staff at present includes Messrs. Hugo and S. Gernsback, H. W. Secor, E.E., and Milton Hymes, Sales Engineer of the Company. Mr. E. L. Hackett is Superintendent of the Manufacturing Division, which has now grown to be a large affair, as the Company makes practically all its own radio instruments, including telephone and wireless head 'phones.

O. B. Millar of Reward, Calif., writes the "Electro" people:

"I have some of your instruments and must say that they are giving the best of satisfaction."

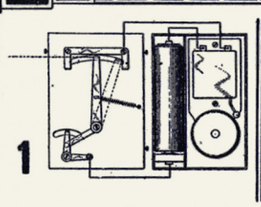
Harry J. Murray of Stamford, Ct., says of us:

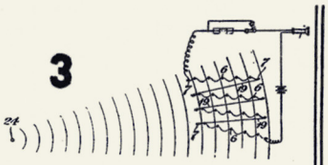
"I take great interest in all departments of your magazine; especially the 'How-to-make-it' department. Wishing all success to the 'Electrical Experimenter,' I remain, yours respectfully, etc."

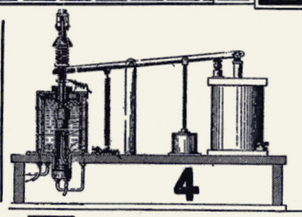
NOTICE!!!

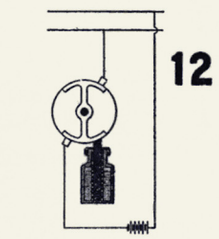
We wish to buy May, '13, Oct., '13 and Jan. '14 copies "E. E." Address the Editor.

LATEST PATENTS









ELECTRIC BURGLAR ALARM (Fig. 1)—A switch arm arranged with spring and a string, so that if string is cut arm flies back, closing bell circuit.

AEROPLANE AERIAL (Fig. 2)—Improved form of elevated antenna for wireless station on aeroplanes, utilizing an insulated non-metallic mast.

MULTIPLE ANTENNA SYSTEM (Fig. 3)—Patent granted on the simultaneous use of a plurality of antennae, spaced half a wave length apart in the direction of the wave train, and all of them connected in series to a common receptor.

HIGH FREQUENCY GENERATOR (Fig. 4)—An arc generator for radio operations, in which the arc takes place in a liquid of high resistance, tending to equalize the spark or arc play and means of automatically regulating arc length by a solenoid.

SPARK-GAP (Fig. 5)—A new spark gap with liquid cooling chamber surrounding the gap chamber. Conical electrodes are used to increase the cooling surface available.

DETACHABLE LAMP SOCKET (Fig. 6)—A useful socket for decorating work, etc., having two corrugated pins to pass thru conductors, and into wood support where available.

RAT TRAP (Fig. 7)—Another electric rat trap, arranged to charge the rats fore and hind legs with plus and minus current, as he touches bait and then depositing his carcass in a water tank below.

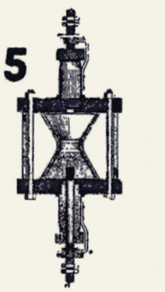
ELECTRICAL EXERCISER (Fig. 8)—An exercising device intended to be worked by the feet on treadles, and to administer faradic current thru the feet and hands while exercising.

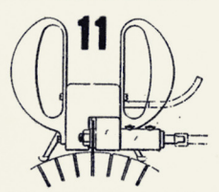
RADIO DETECTOR (Fig. 9)—Improvement in mounting the point electrode on a ball joint, and also providing spring tension on the electrode arm, allowing any part of crystal to be reached easily and quickly.

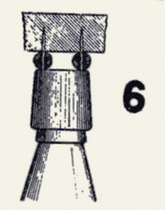
WIRELESS RECEIVER (Fig. 10)—Radio receiving system employing an improved vapor (mercury) electric valve, connected so as to rectify both halves of received radio oscillations, and to impress the resultant rectified current on a reflecting galvanometer.

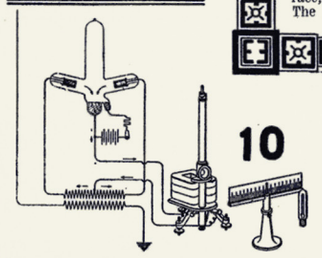
COMMUTATOR MICA TOOL (Fig. 11)—A useful tool with rotary movement to remove high mica from commutator slots.

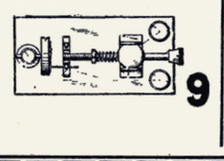
SPARKING PREVENTER (Fig. 12)—A new Edison patent to reduce sparking on commutators, etc., by applying a thin film of completely vaporizable liquid over the contact surface, to maintain the metallic member below its vaporizing point. The film is vaporized. The patent also covers spraying the member.

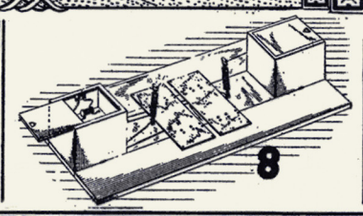


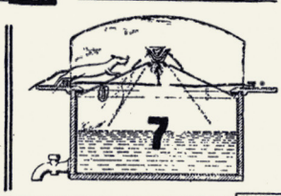












INSTITUTE OF RADIO ENGINEERS.

The November meeting of the Institute was held at Fayerweather Hall, Columbia University, New York City, Wednesday Evening, Nov. 4. The lecture was entitled "Resonance Phenomena in the Low Frequency Circuit," by Mr. H. E. Hallborg, Engineer in Charge of the Marconi Transatlantic radio station at New Brunswick, N. J.

The meeting was well attended and the paper had to do with a very important subject, viz: the proper inductance and capacity relations in the low or audio frequency circuits of radio transmitting sets. This part of such sets is too often neglected severely, as was pointed out by the lecturer and also by several of those present, including Dr. John Stone Stone. He also mentioned the fact that wherever possible the radio transmitter should be designed to operate at unity power factor or as near that figure as possible. Such a condition may be brought about by properly balancing the primary and secondary circuits of the step-up transformer.

In other words the audio frequency circuit should be properly tuned with respect to the secondary or high frequency circuit. Several formulae were given for calculating the proper secondary capacity and inductance, and also the desirable primary values of these quantities. The formulae involved in calculating directly the tuning period of the entire transmitter circuit from the A. C. generator slip rings, thru the static transformer to the condenser across the secondary of same were brought out in discussion by Mr. Julian Barth, a Marconi Engineer.

Vice-President Dr. Stone read a letter from the new Boston section of the Institute, and at their recent initial meeting Dr. G. W. Pierce, the well known radio scientist of Harvard, showed his mercury vapor valve or relay for radio and other work. It appears that this relay possesses some wonderful abilities indeed, as the letter stated that when the lecturer whistled at a distance of 20 feet from a transmitter in the valve circuit, it immediately switched on a bank of lamps; also that its capacity was several kilowatts. Those wishing to join the Institute should communicate with Secretary Emil J. Simon, care of the Institute, 71 Broadway, New York City.

A. F. McCoy, of Brooklyn, N. Y., writes us:

"Your *Electrical Experimenter* is some magazine for a nickel."

MOTHER DYNAMIC.

I.

Intermittently tingling the wires,
Lackadaisically mumbling her tunes,
Repining, exulting, or stifling desires,
She plunges, she hisses, she kisses, she croons.

II.

Mother of man and his handmaiden,
Toiling with ceaseless and purposeful thrift,
Ageing for aye, yet youthful for aye;
Harnessed to motors and myriad lamps,
Sped with her burden of woe or of joy—
Mother Dynamic, Maker of Men!

Out of the bosom of cataracts,
Out of the groans of tumultuous streams,
Bursting from bowels of the storm cloud,
Crowned with light, creator of light;
Forth from Eternity, hence to Eternity—
Mother Dynamic, Maker of Men!

III.

Intermittently tingling the wires,
Lackadaisically mumbling her tunes,
Repining, exulting, or stifling desires,
She plunges, she hisses, she kisses, she croons.

RALPH S. HARRIS,
—(*Edison Monthly*).

AMONG THE AMATEURS

AMATEUR RADIO STATION CONTEST.

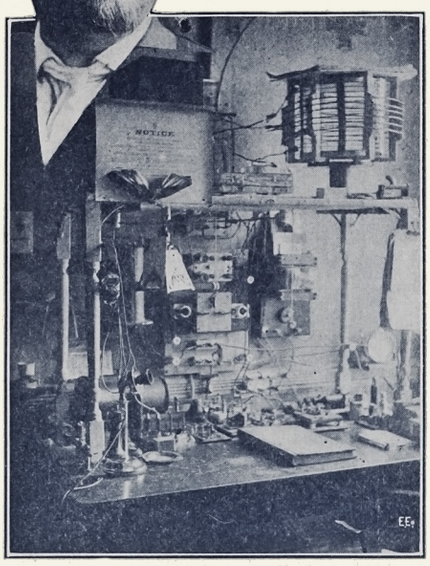
Monthly Prize, $3.00.

This month's prize winner.

AN INTERESTING AMATEUR RADIO STATION.

Here is a photo of my wireless station which is the result of several months' work and experiment. My aerial is composed of two H. D. bare copper wires, No. 10 gauge, each 380 feet long and six feet apart, and 105 feet above the ground. Over 350 feet is over the St. Lawrence river.

The transmitting set is a double one of ½ K. W. capacity; glass plates with tin foil, 6 by 8 inches forms the condenser; helix and spark gap enclosed in a box



Telmosse Radio Station.

lined with asbestos paper; this to lower the noise. I am using across the aerial for my receiving a tubular brass variable condenser 6 inches long by 2½ inches diameter. This eliminates static discharges and induction of lighting lines. I have tuning coil, two silicon detectors and one "Radioson." These are worked with double-throw switches. I am also using as a transmitting set an old telegraph relay which I have specially wired to transmit with other amateurs in town. I am using on both transmitting sets, 110 volts, A. C., 30 cycles. One transformer raises the voltage to about 15,000 volts and the other reduces same to about 12 volts, 15 amperes, variable by 4 point switch contact; all parts are home made such as the two transformers, tuning coil, detectors, except "Radioson," key bases, etc. I am getting all reports from Sayville, Arlington, Cape Race, Glace Bay, et cetera. "Wireless is a great sport."

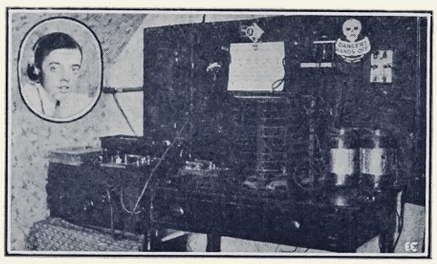
JOS. G. TELMOSSE,
Shawinigan Falls, Que., Can.

Cors Boss, of New London, Ct., an "Electro" patron, says:

"Received *'Electro'* loading coil and it is a neat and small, but efficient instrument. The first time I used it I caught Arlington sending out time signals, which I had been unable to hear before."

R. L. DYE'S RADIO STATION, AT EAST ORANGE, N. J.

This is a photograph of my wireless station and laboratory. The sending set is made up as follows: one ¾ inch spark coil; home-made helix; two home-made Leyden jars; E. I. Co. adjustable spark gap and key. The receiving set is as follows: One double slide tuning coil which is home-made; large fixed con-



Dye Radio Station.

denser; 3 detectors, galena, silicon, and carborundum; 2,000 ohm Brande's 'phones; also a dandy loading coil. Everything was made by myself except 'phones, spark coil, spark gap, key and all necessary switches.

I have obtained the best of results which I am thankful for. My aerial is 50 feet long, 60 feet high at one end and 45 feet at the other and containing 4 wires.

R. LOWELL DYE,
49 North 18th Street,
East Orange, N. J.

UNIVERSITY INSTALLS RADIO PLANT.

What will be the largest wireless aerial station in Ohio, with the possible exception of the government station located at Cleveland, is being installed at the Ohio State University by the department of electrical engineering. The aerial, which is 375 feet long, is being placed at the top of the smokestack of the power house.

With this new station messages can be received from any point on the Pacific Coast as far down as Texas, from all stations on the Atlantic, from Panama on the south and from the extreme end of Canada on the north. Messages can be sent as far west as St. Louis, to Maine on the east, the gulf on the south and the middle of Canada on the north.

Roy B. Shanck, a senior in electrical engineering, will be in charge of the station.

HAWKEYE RADIO ASSOCIATION.

The above Association was organized at a recent meeting held in Des Moines, Iowa, for amateurs in Wireless living in the state of Iowa. The Secretary would be glad to hear from any amateur who would like to join. Also would be glad to correspond with other Clubs. The Central station will be at Ames. Its call is '9YI' and has 2 K.W. power. The officers are: President, Wendell Snyder, Des Moines; Secretary, Ralph Batcher, Toledo, Iowa; Treasurer, Elmer Madson, Ames, Iowa.

WHY THE RADIO AMATEUR?

A correspondent of the Fall River (Mass.) News writes the Editor of same on the benefits of wireless:

To the Editor of the News—For genuine relaxation of the mind, nothing can surpass wireless. It may be thoroly amateurish, both in design and workmanship, and if such, the interest will be greater. Most satisfactory has my apparatus been, not because of the scientific treatment on the subject, but because it has proven restful, and brings even greater results than anticipated.

My set consists of loose coupler, galena and silicon detectors, variable condenser, fixed condenser, Brandes head phones and switches. The aerial consists of four wires, fifty feet long, with a lead-in of thirty feet.

Each night with these instruments I retire in an easy chair in the quiet of my room, compare the time with Arlington, pencil the winds from the four quarters and note the position of derelects. Sayville, W. S. L., with its press and transatlantic exchanges with Berlin, K. A. L., fascinates, while Cape Cod, manipulated by that staid old operator (an automatic transmitter), holds the mind from business perplexities of the day.

L. W.

BIRMINGHAM BOYS FORM WIRELESS ASSOCIATION.

A Junior Wireless Association has been organized and the association will be affiliated with the Birmingham Wireless Association, which is composed of a number of young men who have completed wireless stations. It is proposed that as a member of the Junior Association completes his station and gets in communication by wireless with the other stations in the city he will be promoted to the other association.

The association will have social meetings, will take wireless magazines and do other things that will be helpful to the boys.

LEVEE A RADIO ENTHUSIAST.

For the past two years Allen Levee, son of Willard Levee, of Little Falls, N. Y., has had a wireless telegraph station in operation at the rear of his home on Gansevoort Street. Its radius, however, has been a short one. Now Mr. Levee is so equipping the station that, with the addition of a sixty foot pole, he will be able to receive messages sent from points from 500 to 800 miles away. The young man is an expert wireless operator.

FIRST FREDERICKSBURG, VA., WIRELESS STATION.

Mr. Val Dannehl, Jr., has erected a wireless station on the roof of his father's machine shop. Mr. Dannehl has caught messages from the Arlington station. This is the first wireless station to be erected in this city.

WIRELESS STATION CONTEST

Our Wireless Station Contest is open to all readers, and a monthly prize of $3.00 is offered for the best description and photo of a wireless or electrical laboratory. Be brief and send us dark toned prints in preference to light toned ones and also a small photo of yourself. Write your description on separate sheet of paper. Typewritten copy preferred.

QUESTION BOX

This department is for the sole benefit of the electrical experimenter. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. **At least one of the questions must deal with "E. I. Co." apparatus or instruments, or "E. I. Co." merchandise.**
2. **Only three questions can be submitted to be answered.**
3. **Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.**
4. **Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this Department cannot be answered by mail.**

A. C. CALCULATION.

(194.) W. A. M., R. I., says:

Q. 1. Please state the rule for the calculation of the size wire to be used, for the installation of single phase and three phase 500 Vt., A. C. motors, 60 cycles.

A. 1. The power factor is taken as .80 for motor load only. Current in amperes

$$= \frac{W}{E} \times T; \text{ Where}$$

W = Power in watts delivered by line.
E = Volts delivered per phase.
T = A constant (for S. P, = 1.250).

Circular mils area of each of the two wires (for S. P. system) =

$$\frac{D \times W}{P \times E^2} \times t; —$$

Where D = Length of circuit one way in feet.

P = Per cent of delivered power lost in line (from 3-5% for secondary circuits);

E^2 = Volts delivered (squared);

t = a constant (for this case 3,380).

For three phase motors:

T = .725 and t = 1690; and the circular mils found, will be that each of the three wires, for a three wire, three phase system.

Q. 2. How is the size wire found for electric lighting, on A. C. two wire and three wire systems, 110 and 250 Vts., when the following data is to hand?

The distance away from the transformer box.

The distance from the main distribution. Length of all sub-circuits, taps, etc., number lights, loss of voltage in line, voltage of line and considering ½ ampere for each 16 C.P., 110 volt lamp.

A. 2. The formula for the circular mils area of wire for two wire system is:

$$\text{C.M.} = \frac{21.6 \times 1 \times \text{amperes}}{\text{Drop in volts.}}$$

Where l equals length of circuit in feet, one way.

From 3 to 5 Vts. drop is generally allowed on lighting circuits from transformer to lamp.

For three wire system, use conductors ¼ the size necessary to carry the required load on two wires. This effects a saving of 5/8 of the copper required for a two wire system.

Q. 3. What ampere fuses are allowed on a 250 Vt. D. C. or A. C. arc lamp, using separate switch and cutout for each lamp?

A. 3. Three ampere fuses.

12" SPARK COIL ON 110 VOLTS.

(195.) B. H. McLeod, Douglas, Arizona, writes us:

Q. 1. What current would be taken by my 12" spark coil on 110 volt A. C. circuit with a Gernsback electrolytic interrupter?

A. 1. Most probably your 12" spark coil used with No. 8000 Gernsback interrupter on 110 volt, 60 cycle A. C. circuit will consume about 6 to 8 amperes or an extra choke coil, if necessary can be connected in series with the interrupter; and the choke coil should be similar in size and design to the primary of your spark coil.

Q. 2. What size motor is necessary to drive the "Electro" No. 810 dynamo, and what is the efficiency of the latter machine?

A. 2. We refer you to the E. I. Co. special motor price list (sent gratis) giving quotations on A. C. power motors of all sizes. About ⅛ horsepower A. C. motor should be used to drive their No. 810 dynamo properly, and this dynamo has an electrical efficiency of about 75 per cent.

CAN'T RECEIVE SHORT WAVE LENGTHS.

(196.) K. K. Knaell, Mars, Pa., says:

Q. 1. I can't receive a nearby radio station as he uses a short wave length. What shall I do?

A. 1. Answering your query, will say that most probably you will be able to receive your friend's radio signals if you insert a variable condenser in series with your ground or aerial lead, so as to enable you to tune in shorter wave lengths than the fundamental of your aerial proper; which wave length value is of course, about 4.5 times the length of your aerial including the lead-in and ground wire.

Q. 2. I understand that 2,000 ohm radio receivers are the best; is this so?

A. 2. In regard to wireless receivers, would say that while 2,000 ohms per pair is very good, it has been found that 3,000 ohms for a pair of receivers is very good, providing they are properly designed, and the best "Electro" 'phones are their 3,000 ohm type No. 6666.

TAPE REGISTERS ON RADIO RECEPTORS.

(197.) H. T. Chilton, Muncie, Ill., asks us:

Q. 1. How can I use a polarized relay with an electrolytic detector?

A. 1. Relative to using a relay together with an auxiliary apparatus for same in connection with a radio receiving set utilizing an ordinary detector of the crystal or electrolytic type would say that if this form of detector is to be used, (and not a coherer of the filings type), you will have to use very high resistance relay, as fully described in the March, 1914, Electrical Experimenter; and 6000 to 7000 ohms resistance in the polarized relay winding would be necessary. The armature of such a standard relay is entirely too heavy for the purpose which you have in mind and the above mentioned magazine article explains how to make very light and sensitive armature, etc.

With your diagram and general arrangement shown you would have to use a filings coherer; also but one dry cell should be used in series with the relay windings and the coherer itself.

110 VOLT TRANSMITTING SET ON BATTERIES.

(198.) Geo. D. Todd, Jr., Louisville, Ky., writes us in regard to utilizing an E. I. Co. style S. O. 200 wireless sending set on battery current?

A. 1. Would advise that if your type S. O. 200 transmitting set is to be converted or operated in connection with batteries at 20 volts, etc., your probable transmitting range would be 20 to 25 miles depending on the weather conditions, etc.

"Electro" rotary spark gaps suitable for sets up to one K. W. capacity and equipped with 110 volt A. C. or D. C. Universal motors are worth $15.00, or if fitted with 6 to 8 volt battery motor $12.00.

LONG DISTANCE RADIO RECEIVING.

(199.) S. W. C., So. Portland, Me., asks us several Radio queries:

A. 1. We would answer your questions as follows: We would say that to operate simultaneously 2 spark coils, the windings should be connected in series and one vibrator is then used for interrupting the primary current of both coils and of course more battery voltage is to be used as the 2 primary windings have a greater resistance than one coil only; and their out-put under the proper conditions as just outlined, will be equal to that of both coils, when operating independently.

In regard to your radio receiving range, would suggest that this will be probably 1200 to 1500 miles or more under good conditions, especially at night. It might be possible that you could hear the Clifden, Ireland, station of the Marconi Company, but you will have to use for this purpose the very best receiving apparatus possible and some form of amplifier would be necessary, we believe from our experience in the matter.

All of the European wireless stations, including that at Hanover, Germany, are heard at the Columbia University Radio Station, and their aerial is about 550 feet long of 4 strands of Phosphor bronze cable, spaced about 5 feet apart and elevated about 130 feet above the ground. Needless to say they are using a form of highly perfected amplifier developed in their research laboratory and data on same is not available at present.

TARGON LAMPS TO REVOLUTIONIZE LIGHTING.

The most powerful electric lamp known to science, thirty-four times more brilliant than the street arc lights now in use, has just been invented by Dr. Frederick Keys, formerly professor of physical chemistry in the Massachusetts Institute of Technology. It was publicly exhibited for the first time at the Electrical Exposition in Grand Central Palace, New York City. This new lamp is an incandescent lamp of mazda tungsten filament, burning in a gas known as Targon, which is extracted from the atmosphere. In this respect it differs from the other types of mazda lamps, which burn in a vacuum.

Three of these new lights were suspended on the Lexington avenue front of the palace, two being of 6,000 candle power each and one of 12,000 candle power. The former lamp consumes only 2,750 watts and the latter but 5,500 watts. Dr. Keys has been working on his invention for some time in the Cooper-Hewitt laboratories in Hoboken.

A DISCUSSION ON "ELECTRICITY AND LIFE."*

The following discussion will endeavor to show the plausibility of the theory that solar force is our vital force.

In the first place, human beings are as much an integral part of the earth as are stones, trees, etc., in structure. Man, of course, has intelligence, consciousness, and will-power, but without the physical body, these qualities would not be manifest to us, and so may be considered distinct. The chemical relationship between the body and earth can be definitely traced by means of the "nitrogen cycle" of Nature. Nitrogen plus hydrogen becomes ammonia. This combines with oxygen compounds in the soil to form nitrites. Nitrites are oxidized to nitrates; plants convert nitrates into plant protein, and animals, being nourished directly or indirectly from the plants, form animal protein. Then the waste products of the human or animal body are again decomposed into ammonia and nitrogen, and the cycle begins again. The fatty and mineral tissues can also be traced in a somewhat similar way. It is thus seen that our bodies are in reality a part of the earth, since they are directly derived from it, and ultimately return to it. We also know that the human embryo passes thru all the stages of pre-human evolution during its formation, and that modern science hesitates to set a boundary between animation and inanimation, since late research has shown the metals to possess properties that are remarkably similar to functions of animal life.

Biology can trace evolution from the simple cell to the human being. Biochemistry can show the chemical constitution of the cell, and has even succeeded in synthesizing one of the lower proteins. The ionic theory shows that the chemical activity of an electrolyte is due to an electric charge on the atom. Radium emanation is accompanied by an electric discharge, and can transmute metals, and break down the cell-structure of the body, as can also the X-Ray.

Science has demonstrated the sun to be an immense magnet, and has also shown that a solar magnetic disturbance is accompanied by an instantaneous corresponding disturbance of the earth's magnetic state. Since the earth is in the solar system, it is within the magnetic field of the sun, and becomes an immense armature by its axial rotation. Is it, therefore, a wild dream of a diseased imagination to think that, since we can trace evolution from the very atom, and can show the electric nature of atomic structure, and the relationship between our bodies and the earth, and the earth and sun, that our vital force is solar electricity, and that we, at the moment of birth, become individual electrons in the atom, the Nation; in the molecule Humanity; in the chemical compound, the Solar System, which is held in solution in the solvent, Space?

Contributed by E. R. W.,
Dartmouth College, Hanover, N. H.

*This article appeared on page 111 of the Nov., 1914, Electrical Experimenter, and has caused much criticism and comment.

ELECTRICITY AND WATER PIPES.

Two or three instances of that by no means rare trouble with water pipes that is caused by vagrant electricity have recently damaged the houses or residents of Palisade, N. J. Shortly before it was burned down the house of Richard Bennett was a victim.

Leaks in the water pipes had given much annoyance, but their cause was not discovered until Mr. Bennett got an expert from the Hackensack Water Company to come and look over the premises. Then it was found that there was a positive current of .8 volts in a 5/8-inch lead pipe from the house to the trolley tracks, 300 feet away, and a negative current of 2.6 volts from the rails to the house. That was at 2.40 P. M., when the current was probably at its weakest.

The water company's expert said that the outgoing current produced a decomposition of the lead and gradually ate small holes in the piping.

The homes of Paul T. Brady and David Arthur Carson, in the same town, had previously had similar experiences.

PORT JERVIS JEWELER HAS RADIO.

This city is soon to be provided with a wireless apparatus station to be installed by the erection of poles in the yard of the store of jeweler, A. W. Smith, on Front Street, Port Jervis, N. Y.

Manager Conrad Diehl, of the Western Union office, will have charge of the work. The object of the wireless outfit is that this city can record exactly the falling of the time ball at Washington each noon, thereby furnishing this city with absolutely correct government time.

D. Frederick Primm of St. Louis, Mo., says:

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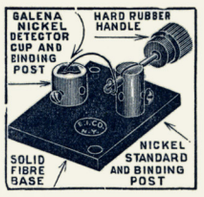

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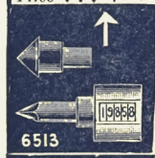

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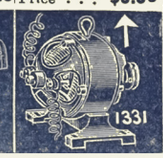

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